AMENDMENTS TO THE CLAIMS

A detailed listing of all claims that are, or were, in the present application, irrespective of whether the claim(s) remains under examination in the application are presented below. The claims are presented in ascending order and each includes one status identifier.

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1. (Previously Presented) A photonic crystal waveguide comprising:

a core formed of a photonic crystal having periodicity in a first direction and propagating an electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a photonic band structure having a Brillouin zone boundary and a photonic band thereon comprising a propagation mode in which the electromagnetic wave is propagated a homogeneous medium cladding having a refractive index n_s; and

the core further comprising a side face parallel to the first direction, the side face in contact with the homogeneous medium cladding, the side face satisfying the condition:

$$\lambda_0/n_s > a\lambda/(\lambda^2/4+a^2)^{0.5}$$

where λ_0 denotes a wavelength of the electromagnetic wave in a vacuum, a denotes a period of the photonic crystal, and λ denotes a period of the wave propagated through the core in the second direction perpendicular to the first direction.

2. (Previously Presented) The photonic crystal waveguide according to claim 1, further comprising a confinement cladding formed of at least one of a homogeneous material or a photonic crystal having periodicity in at least the first direction and arranged on a surface of the core perpendicular to the first direction to prevent the electromagnetic wave propagated through the core from leaking out of the surface.

3. (Previously Presented) The photonic crystal waveguide according to claim 1 wherein a width 2L of the core in a direction perpendicular to a longitudinal direction of the waveguide is in a range of:

$s\lambda/2\cos\phi_0 \leq 2L<(s+1)\lambda/2\cos\phi_0$

when a propagation angle ϕ of the electromagnetic wave satisfying::

$\lambda_0/n_s-a(\lambda/\cos\phi)/\{(\lambda/2\cos\phi)^2+a^2\}^{0.5}=0$

is in the range of $0<\phi<90°$, the value in the range defined as a maximum value ϕ_0 of propagation angles at which the electromagnetic wave is confined by the side face, and a phase shift amount is $s\pi$ when the wave propagated through the core is reflected by the side face at the maximum value ϕ_0 of the propagation angle, and s is in a range of $0 \leq s \leq 1$.

4. (Previously Presented) The photonic crystal waveguide according to claim 1 wherein a phase shift amount is $s\pi$ when the wave propagated through the core in the second direction perpendicular to the first direction is perpendicularly incident on the side face and reflected thereby, s is in the range $0 \leq s \leq 1$, and the conditions:

$\lambda_0/n_s-2a>0$ and

$s\lambda/2 \leq 2L$

are satisfied.

5. (Previously Presented) The photonic crystal waveguide according to claim 4, wherein a width 2L of the core in a direction perpendicular a longitudinal direction of the waveguide is in a range of:

$s\lambda/2 \leq 2L<(s+1)\lambda/2.$

6. (Previously Presented) The photonic crystal waveguide according to claim 1 further comprising a confinement cladding layer formed of a photonic crystal having periodicity in at least the first direction and formed of the same materials as the core, arranged on a surface of the core, and wherein a photonic bandgap is formed by the confinement cladding layer in the first direction confining the propagation mode in the first direction of the core, while making radiation modes similar to the propagation mode.

7. (Previously Presented) The photonic crystal waveguide according to claim 1 further comprising a phase modulating device on an end face of the core, such that a periodic structure thereof is exposed, the phase modulating device operable for coupling the wave propagated through the core to an external plane wave.

8. (Previously Presented) The photonic crystal waveguide according to claim 7, wherein when n denotes a refractive index of an external medium and λ_0 denotes a wavelength of an external plane wave in a vacuum, the phase modulating device using the end face of the core parallel to the first direction as an external coupling face, such that the phase modulating device couples, in the coupling face, plane waves having an incident angle θ in the first direction represented by the formula:

$$n \cdot \sin\theta \cdot (a/\lambda_0) = 0.5$$

to the end face.

9. (Previously Presented) The photonic crystal waveguide according to claim 7, wherein when n denotes a refractive index of an external medium and λ_0 denotes a wavelength of an external plane wave in a vacuum, the phase modulating device using the end face of the core parallel to the first direction as an external coupling face, and, in the coupling face, causes two planes having the same phase and having incident angles $\pm\theta$ in the first direction represented by the formula:

$$n \cdot \sin\theta \cdot (a/\lambda_0) = 0.5$$

to interfere with each other to couple them to the end face.

10. (Previously Presented) The photonic crystal waveguide according to claim 7, wherein

the phase modulating device is a phase grating arranged proximate an incident surface, which is an end face of the core parallel to the one direction, and has a period in the same direction as the photonic crystal forming the core that is twice the period of the photonic crystal; and

the phase grating couples the external plane wave to the electromagnetic wave propagated through the core.

11. (Previously Presented) The photonic crystal waveguide according to claim 7, wherein the phase modulating device is a phase grating arranged proximate the end face of the core parallel to the first direction, and has the same period in the same direction as the photonic crystal forming the core; and

at least one of an incident angle or exit angle θ of an external plane wave coupled to the electromagnetic wave propagated through the core by the phase grating satisfies the formula:

$n \cdot \sin\theta \cdot (a/\lambda_0) = 0.5$

where n denotes a refractive index of an external medium, and λ_0 denotes a wavelength of the external plane wave in vacuum.

12. (Previously Presented) The photonic crystal waveguide according to claim 7, wherein the phase modulating device is a phase grating arranged proximate the end face of the core parallel to the first direction, and has a period in the same direction as the photonic crystal forming the core that is twice the period of the photonic crystal; and

an incident angle or exit angle θ of the external plane wave coupled to the wave propagated through the core by the phase grating satisfies the formula:

$n \cdot \sin\theta \cdot (a/\lambda_0) = 0.5$

where n denotes a refractive index of an external medium, and λ_0 denotes a wavelength of the external plane wave in a vacuum.

13. (Previously Presented) The photonic crystal waveguide according to claim 7, wherein the core comprises a slant end face inclined with respect to the first direction and the phase modulating device directly couples the external plane wave to the slant end face of the core.

14. (Previously Presented) The photonic crystal waveguide according to claim 13, further comprising at least one of one of a prism or mirror arranged proximate the slant end face of the core to change an incoming direction or an outgoing direction of the external plane wave.

15. (Previously Presented) The photonic crystal waveguide according to claim 14, wherein the incoming direction or outgoing direction of the external plane wave is matched with a propagation direction in the core formed by the photonic crystal.

16. (Previously Presented) The photonic crystal waveguide according to claim 14, wherein the incoming direction or outgoing direction of the external plane wave is perpendicular to a propagation direction in the core formed by the photonic crystal.

17. (Previously Presented) The photonic crystal waveguide according to claim 14, comprising a prism having a refractive index of 3 or more.

18. (Previously Presented) The photonic crystal waveguide according to claim 14, further comprising a diffraction grating arranged proximate the slant end face.

19. (Previously Presented) The photonic crystal waveguide according to claim 18, wherein the incoming direction or the outgoing direction of the external plane wave coupled to the wave propagated through the core by the diffraction grating is matched with a propagation direction in the core formed of the photonic crystal.

20. (Previously Presented) The photonic crystal waveguide according to claim 1, wherein a width of the core perpendicular to a longitudinal direction of the waveguide is tapered.

21. (Previously Presented) A photonic crystal waveguide comprising:

a core formed of a photonic crystal having periodicity in a first direction and propagating an electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a photonic band structure having a Brillouin zone center line and a high-order photonic band thereon comprising a propagation mode in which the electromagnetic wave is propagated a homogeneous medium cladding having a refractive index n_s; and

the core comprising a side face parallel to the first direction ~~is~~ in contact with the homogeneous medium cladding the side face satisfying the condition:

$\lambda_0/n_s-\lambda>0$

where λ_0 denotes a wavelength of the electromagnetic wave in vacuum, a denotes a period of the photonic crystal, and λ denotes a period of the wave propagated through the core in the second direction perpendicular to the first direction.

22. (Previously Presented) The photonic crystal waveguide according to claim 21, further comprising a confinement cladding, formed at least one of a homogeneous material or a photonic crystal having periodicity in at least the first direction, and arranged on a surface of the core perpendicular to the first direction for preventing the electromagnetic wave propagated through the core from leaking out of the surface.

23. (Previously Presented) The photonic crystal waveguide according to claim 21 wherein width 2L of the core in a direction perpendicular to a longitudinal direction of the waveguide is in a range of:

$s\lambda/2\cos\phi_0 \leq 2L<(s+1)\lambda/2\cos\phi_0$

with a propagation angle ϕ of the electromagnetic wave satisfying:

$\lambda_0/n_s-\lambda/\cos\phi=0$

and being in a range of $0<\phi<90°$, with a value in this range being defined as a maximum value ϕ_0 of propagation angles at which the electromagnetic wave is confined by the side face; and

wherein a phase shift amount is $s\pi$ when the wave propagated through the core is reflected by the side face at the maximum value ϕ_0 of the propagation angle, and s being in the range $0 \leq s \leq 1$.

24. (Previously Presented) The photonic crystal waveguide according to claim 21 further comprising

a confinement cladding layer, which is formed of a photonic crystal having a periodicity in at least the first direction, is formed of the same materials as the core and is arranged on a surface of the core, and

a photonic bandgap formed by the confinement cladding layer confining the propagation mode in the first direction of the core, while making radiation modes similar to the propagation mode.

25. (Previously Presented) The photonic crystal waveguide according to claim 21 further comprising:

a phase modulating device on an end face of the core where a periodic structure thereof is exposed, the phase modulating device operable for coupling the electromagnetic wave propagated through the core to an external plane wave.

26. (Previously Presented) The photonic crystal waveguide according to claim 25, wherein when n denotes a refractive index of an external medium and λ_0 denotes a wavelength of the external plane wave in a vacuum, the phase modulating device using the end face of the core parallel to the first direction as an external coupling face, and, in the coupling face, causes two plane waves having the same phase and having an incident angle $\pm\theta$ in the first direction that is represented by the formula:

$$n \cdot \sin\theta \cdot (a/\lambda_0) = 1.0$$

to interfere with each other to couple them to the end face.

27. (Previously Presented) The photonic crystal waveguide according to claim 25, wherein when n denotes a refractive index of an external medium, and λ_0 denotes a wavelength of the external plane wave in a vacuum, the phase modulating device using the end face of the core parallel to the first direction as an external coupling face, and, in the coupling face, causes two plane waves having the same phase and having an incident angle $\pm\theta$ in the first direction that is represented by the formula:

$$n \cdot \sin\theta \cdot (a/\lambda_0) = 1.0$$

and the plane wave with θ=0 to interfere simultaneously to couple them to the end face.

28. (Previously Presented) The photonic crystal waveguide according to claim 25, wherein:

the phase modulating device is a phase grating arranged proximate an incident surface, and has a same period in a same direction as the photonic crystal forming the core; and

the phase grating couples the external plane wave to the electromagnetic wave propagated through the core.

29. (Previously Presented) The photonic crystal waveguide according to claim 21 wherein a width of the core perpendicular to a longitudinal direction of the waveguide is tapered.

30. (Withdrawn) A homogeneous medium waveguide comprising:

a core formed of a homogeneous medium having a refractive index n_0 and a limited thickness in a first direction and propagating the electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a side face parallel to a propagation mode in which the electromagnetic wave is propagated in the first direction a homogeneous medium cladding having a refractive index n_s in which the side face of the core parallel to the first direction is in contact with the homogeneous medium cladding, the side face satisfying the condition:

$n_s<n_0$.

31. (Withdrawn) The homogeneous medium waveguide according to claim 30, further comprising a confinement cladding formed of at least one of a homogeneous material or a photonic crystal having a periodicity in at least the first direction, ~~is~~ arranged on a surface of the core perpendicular to the first direction to prevent the electromagnetic wave propagated through the core from leaking out of the surface.

32. (Withdrawn) The homogeneous medium waveguide according to claim 30, wherein a width 2L of the core in a longitudinal direction of the waveguide is in a range of:

$s\lambda_0\cos\psi/2\sin\phi_0 \leq 2L<(s+1)\lambda_0\cos\psi/2\sin\phi_0$

with a propagation angle ϕ of the electromagnetic wave satisfying:

$n_s-n_0\{\sin^2\psi+\cos^2\psi\cos^2\phi\}^{0.5}=0$

and being in a range of $0<\phi<90°$, the value in this range being defined as a maximum value ϕ_0 of propagation angles at which the electromagnetic wave is confined by the side face, and

a phase shift amount is $s\pi$ when the wave propagated through the core is reflected by the side face at the maximum value ϕ_0 of the propagation angle, and s being in a range of $0 \leq s \leq 1$.

33. (Withdrawn) The homogeneous medium waveguide according to claim 30, wherein when a phase shift amount is $s\pi$ and the wave propagated through the core in a direction perpendicular to the first direction is perpendicularly incident on the side face and reflected thereby, s is in a range of $0 \leq s \leq 1$, and the conditions:

$n_s-n_0\sin\psi<0$ and

$s\lambda_0\cos\psi/2 \leq 2L$

are satisfied.

34. (Withdrawn) The homogeneous medium waveguide according to claim 33, wherein a width 2L of the core is in a range of:

$s\lambda_0\cos\psi/2 \leq 2L<(s+1)\lambda_0\cos\psi/2$.

35. (Withdrawn) The homogeneous medium waveguide according to claim 30, wherein an external plane wave having an incident angle θ in the first direction is represented by the formula:

$\sin\theta=(n_0/n_m)\sin\psi$

where n_0 denotes a refractive index of the core, n_m denotes a refractive index of the incident light side, and ψ denotes a propagation angle of high-order mode light propagated through the core, is coupled to an end face of the core parallel to the first direction, such that the external plane wave is used as incident light or outgoing light.

36. (Withdrawn) The homogeneous medium waveguide according to claim 30, wherein an external plane wave is coupled to a slant end face of the core that is inclined with respect to the first direction, and the external plane wave has an incident angle for coupling to a high-order mode of a propagation angle ψ in the first direction, such that the external plane wave is used as incident light or outgoing light.

37. (Withdrawn) The homogeneous medium waveguide according to claim 30, wherein the core comprises a slant end face inclined with respect to the first direction, the homogeneous medium waveguide further comprising at least one of a prism or mirror ~~is~~ arranged proximate the slant end face to couple high-order mode light in the first direction propagated through the core to an external plane wave so that the external plane wave is used as incident light or outgoing light.

38. (Withdrawn) The homogeneous medium waveguide according to claim 37, wherein an incoming direction or an outgoing direction of the external plane wave is matched with a propagation direction in the waveguide.

39. (Withdrawn) The homogeneous medium waveguide according to claim 37, wherein an incoming direction or an outgoing direction of the external plane wave is perpendicular to a propagation direction in the waveguide.

40. (Withdrawn) The homogeneous medium waveguide according to claim 37, comprising a prism having a refractive index of 3 or more.

41. (Withdrawn) The homogeneous medium waveguide according to claim 30, wherein the core comprises a slant end face inclined with respect to the first direction, the homogeneous medium waveguide further comprising a diffraction grating ~~is~~ arranged proximate the slant end face of the core.

42. (Withdrawn) The homogeneous medium waveguide according to claim 41, wherein an incoming direction or an outgoing direction of the external plane wave is matched with a propagation direction in the waveguide.

43. (Withdrawn) The homogeneous medium waveguide according to claim 30, wherein the core comprises an end face parallel to the first direction, the homogeneous medium waveguide further comprising a phase grating proximate the end face of the core that is parallel to the first direction, and diffraction light of the external plane wave by the phase grating is coupled to high-order mode light propagated through the core in the first direction, such that the plane wave is used as incident light or outgoing light.

44. (Withdrawn) The homogeneous medium waveguide according to claim 30, wherein a width of the core in a direction perpendicular to a longitudinal direction of the waveguide is tapered.

45. (Previously Presented) An optical device for use as a directional coupler, the optical device comprising two waveguides formed to be bent proximate each other in a coupling region having a predetermined coupling length, in which each of the two waveguides is formed of a photonic crystal waveguide, with each photonic crystal waveguide comprising:

a core formed of a photonic crystal having periodicity in a first direction and which propagates an electromagnetic wave in a second direction perpendicular to the first direction, the

core comprising a photonic band structure having a Brillouin zone boundary and a photonic band present thereon comprising a propagation mode in which the electromagnetic wave is propagated;

a homogeneous medium cladding having a refractive index n_s; and

the core comprising a side face parallel to the first direction in contact with the homogeneous medium cladding, the side face satisfying the condition:

$\lambda_0/n_s>a\lambda/(\lambda^2/4+a^2)^{0.5}$

where λ_0 denotes a wavelength of the electromagnetic wave in a vacuum, a denotes a period of the photonic crystal, and λ denotes a period of the wave propagated through the core in the second direction perpendicular to the first direction.

46. (Previously Presented) An optical device for use as a Mach Zehnder optical switch, the optical device comprising a first single linear waveguide, two branched waveguides branched from the first single linear waveguide, and a second single linear waveguide formed by merging the two branched waveguides, in which each of the waveguides is formed by a photonic crystal waveguide comprising:

a core formed of a photonic crystal having periodicity in a first direction and which propagates an electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a photonic band structure having a Brillouin zone boundary and a photonic band present thereon comprising a propagation mode in which the electromagnetic wave is propagated;

a homogeneous medium cladding having a refractive index n_s; and

the core comprising a side face parallel to the first direction in contact with the homogeneous medium cladding, the side face satisfying the condition:

$\lambda_0/n_s > a\lambda/(\lambda^2/4+a^2)^{0.5}$

where λ_0 denotes a wavelength of the electromagnetic wave in a vacuum, a denotes a period of the photonic crystal, and λ denotes a period of the wave propagated through the core in the second direction perpendicular to the first direction.

47. (Previously Presented) An optical device for use as an optical delay line, the optical device comprising a linear waveguide and a single waveguide having a delay portion, wherein each of the waveguides and the delay portion are formed of a photonic crystal waveguide comprising:

a core formed of a photonic crystal having periodicity in a first direction and which propagates electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a photonic band structure having a Brillouin zone boundary and a photonic band present thereon comprising a propagation mode in which the electromagnetic wave is propagated;

a homogeneous medium cladding having a refractive index n_s; and

the core comprising a side face parallel to the first direction in contact with the homogeneous medium cladding, the side face satisfying the condition:

$\lambda_0/n_s > a\lambda/(\lambda^2/4+a^2)^{0.5}$

where λ_0 denotes wavelength of the electromagnetic wave in a vacuum, a denotes a period of the photonic crystal, and λ denotes a period of the wave propagated through the core in the second direction perpendicular to the first direction

48. (Withdrawn) An optical device for use as a dispersion control device, the optical device comprising a waveguide formed of a photonic crystal waveguide comprising:

a core formed of a photonic crystal having periodicity in a first direction and which propagates electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a photonic band structure having a Brillouin zone boundary and a photonic band present thereon comprising a propagation mode in which the electromagnetic wave is propagated;

a homogeneous medium cladding having a refractive index n_s; and

the core comprising a side face parallel to the first direction in contact with the homogeneous medium cladding, the side face satisfying the condition:

$\lambda_0/n_s>a\lambda/(\lambda^2/4+a^2)^{0.5}$

where λ_0 denotes a wavelength of the electromagnetic wave in a vacuum, a denotes a period of the photonic crystal, and λ denotes a period of the wave propagated through the core in the second direction perpendicular to the first direction, wherein propagated light having a large dispersion condition is propagated through the waveguide.

49. (Previously Presented) An optical device comprising:

a photonic crystal waveguide comprising:

a core formed of a photonic crystal having periodicity in a first direction and which propagates electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a photonic band structure having a Brillouin zone boundary and a photonic band present thereon comprising a propagation mode in which the electromagnetic wave is propagated;

a homogeneous medium cladding having a refractive index n_S; and

the core comprising a side face parallel to the first direction in contact with the homogeneous medium cladding, the side face satisfying the condition:

$\lambda_0/n_S > a\lambda/(\lambda^2/4+a^2)^{0.5}$

where λ_0 denotes a wavelength of the electromagnetic wave in a vacuum, a denotes the period of a photonic crystal, and λ denotes a period of the wave propagated through the core in the second direction perpendicular to the first direction, the core comprising a material having nonlinear characteristics; and

the waveguide comprising two surfaces and the optical device further comprising two electrodes arranged on the two surfaces of the waveguide in the first direction.

50. (Currently Amended) [[the]] <u>The</u> optical device of claim 49, further comprising a modulator for changing a voltage or an electric current applied to the two electrodes.

51. (Previously Presented) An optical device comprising:

a photonic crystal waveguide comprising:

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a core formed of a photonic crystal having periodicity in a first direction and which propagates an electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a photonic band structure having a Brillouin zone boundary and a photonic band present thereon comprising a propagation mode in which the electromagnetic wave is propagated;

a homogeneous medium cladding having a refractive index n_s; and

the core comprising a side face parallel to the first direction in contact with the homogeneous medium cladding, the side face satisfying the condition:

$\lambda_0/n_s > a\lambda/(\lambda^2/4+a^2)^{0.5}$

where λ_0 denotes a wavelength of the electromagnetic wave in a vacuum, a denotes a period of the photonic crystal, and λ denotes a period of the wave propagated through the core in the second direction perpendicular to the first direction, wherein the cladding is confined imperfectly to generate refracted light from the core.

52. (Withdrawn) An optical device for use as a directional coupler, the optical device comprising:

two waveguides formed to be bent proximate each other in a coupling region having a predetermined coupling length, in which each of the waveguides is formed of a homogeneous medium waveguide comprising:

a core formed of a homogeneous medium having a refractive index n_0 and a limited thickness in a first direction which propagates an electromagnetic wave in a second direction

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perpendicular to the first direction, the core comprising a side face parallel to a propagation mode in which the electromagnetic wave is propagated in the first direction; and

a homogeneous medium cladding having a refractive index n_s in which the side face of the core parallel to the first direction is in contact with the homogeneous medium cladding, the side face satisfying the condition:

$n_s<n_0$.

53. (Withdrawn) An optical device for use as a Mach Zehnder optical switch, the optical device comprising:

a first single linear waveguide, two branch waveguides branched from the first single linear waveguide, and a second single linear waveguide formed by merging the two branch waveguides, wherein each of the waveguides are formed of a homogeneous medium waveguide comprising:

a core formed of a homogeneous medium having a refractive index n_0 and a limited thickness in a first direction which propagates an electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a side face parallel to a propagation mode in which the electromagnetic wave is propagated in the first direction; and

a homogeneous medium cladding having a refractive index n_s in which the side face of the core parallel to the first direction is in contact with the homogeneous medium cladding, the side face satisfying the condition:

$n_s<n_0$.

54. (Withdrawn) An optical device for use as an optical delay line, the optical device comprising:

a linear waveguide and a single waveguide having a delay portion, each of the waveguides and the delay portion formed of a homogeneous medium waveguide comprising:

a core formed of a homogeneous medium having a refractive index n_0 and a limited thickness in a first direction which propagates an electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a side face parallel to a propagation mode in which the electromagnetic wave is propagated in the first direction; and

a homogeneous medium cladding having a refractive index n_s in which the side face of the core parallel to the first direction is in contact with the homogeneous medium cladding, the side face satisfying the condition:

$n_s<n_0$.

55. (Withdrawn) An optical device for use as a dispersion control device, the optical device comprising a homogeneous medium waveguide comprising:

a core formed of a homogeneous medium having a refractive index n_0 and a limited thickness in a first direction which propagates an electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a side face parallel to a propagation mode in which the electromagnetic wave is propagated in the first direction; and

a homogeneous medium cladding having a refractive index n_s in which the side face of the core parallel to the first direction is in contact with the homogeneous medium cladding, the side face satisfying the condition:

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$n_s < n_0$,

wherein the propagated light comprises a large dispersion condition.

56. (Withdrawn) An optical device comprising:

a homogeneous medium waveguide comprising:

a core formed of a homogeneous medium having a refractive index n_0 and a limited thickness in a first direction which propagates an electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a side face parallel to a first direction propagation mode in which the electromagnetic wave is propagated in the first direction; and

a homogeneous medium cladding having a refractive index n_s in which the side face of the core parallel to the first direction is in contact with the homogeneous medium cladding, the side face satisfying the condition:

$n_s < n_0$,

the core comprising a material having nonlinear characteristics; and

two electrodes arranged on two surfaces of the waveguide in the first direction.

57. (Withdrawn) An optical device being comprising:

a homogeneous medium waveguide comprising:

a core formed of a homogeneous medium having a refractive index n_0 and a limited thickness in a first direction which propagates an electromagnetic wave in a second direction perpendicular to the first direction, the core comprising a side face parallel to a propagation mode in which the electromagnetic wave is propagated in the first direction; and

a homogeneous medium cladding having a refractive index n_s in which the side face of the core parallel to the first direction is in contact with the homogeneous medium cladding, the side face satisfying the condition:

$n_s<n_0$,

the core comprising a material having nonlinear characteristics;

the waveguide further comprising:

two surfaces, wherein two electrodes are arranged on the two surfaces of the waveguide in the first direction; and

a modulator for changing a voltage or an electric current applied to the two electrodes.

58. (Withdrawn) An optical device comprising:

a homogeneous medium waveguide comprising:

a core formed of a homogeneous medium having a refractive index n_0 and a limited thickness in a first direction, the core propagating an electromagnetic wave in a second direction

perpendicular to the first direction, the core comprising a side face parallel to a propagation mode in which the electromagnetic wave is propagated in the first direction; and

a homogeneous medium cladding having a refractive index n_s in which the side face of the core parallel to the first direction is in contact with the homogeneous medium cladding, the side face satisfying the condition:

$n_s<n_0$,

wherein the cladding is imperfectly confined to generate refracted light from the core.